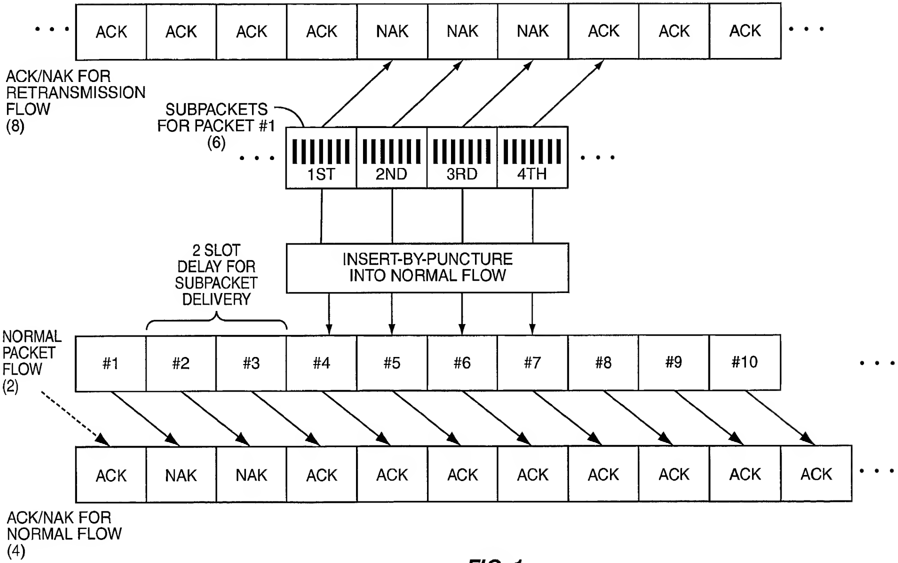
ACK/NAK FOR RETRANSMISSION FLOW (8)
ACK
ACK
ACK
ACK
NAK
NAK
NAK
ACK
ACK
ACK
SUBPACKETS FOR PACKET #1 (6)
1ST
2ND
3RD
4TH
INSERT-BY-PUNCTURE INTO NORMAL FLOW
2 SLOT DELAY FOR SUBPACKET DELIVERY
NORMAL PACKET FLOW (2)
#1
#2
#3
#4
#5
#6
#7
#8
#9
#10
ACK/NAK FOR NORMAL FLOW (4)
ACK
NAK
NAK
ACK
ACK
ACK
ACK
ACK
ACK
ACK
ACK

FIG. 1

20ET20' T0Z4Z00T

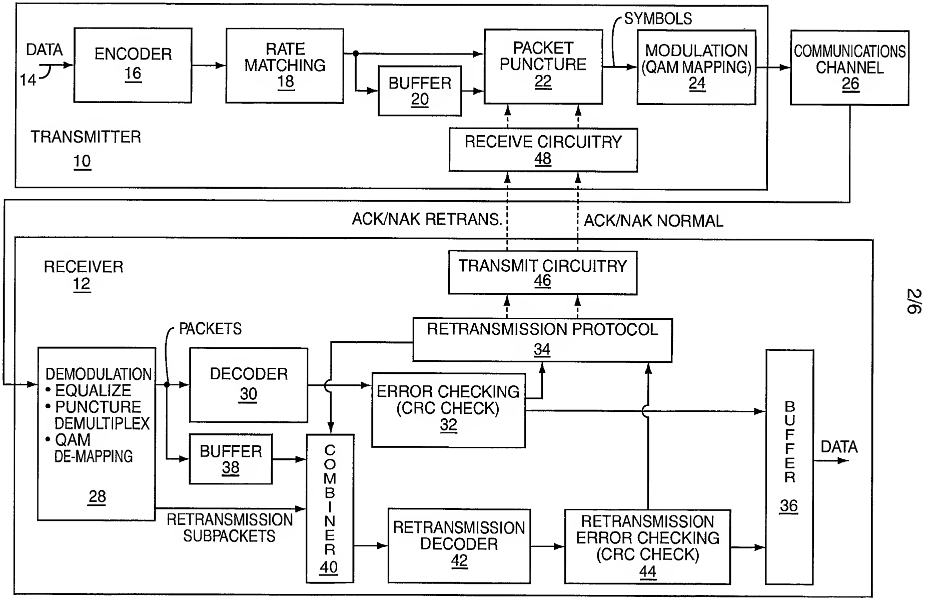
DATA
14
ENCODER
16
RATE MATCHING
18
BUFFER
20
PACKET PUNCTURE
22
SYMBOLS
MODULATION (QAM MAPPING)
24
COMMUNICATIONS CHANNEL
26
TRANSMITTER
10
RECEIVE CIRCUITRY
48
ACK/NAK RETRANS.
ACK/NAK NORMAL
RECEIVER
12
TRANSMIT CIRCUITRY
46
RETRANSMISSION PROTOCOL
34
PACKETS
DEMODULATION
• EQUALIZE
• PUNCTURE DEMULTIPLEX
• QAM DE-MAPPING
28
DECODER
30
BUFFER
38
ERROR CHECKING (CRC CHECK)
32
COMBINER
40
RETRANSMISSION SUBPACKETS
RETRANSMISSION DECODER
42
RETRANSMISSION ERROR CHECKING (CRC CHECK)
44
BUFFER
36
DATA

FIG. 2

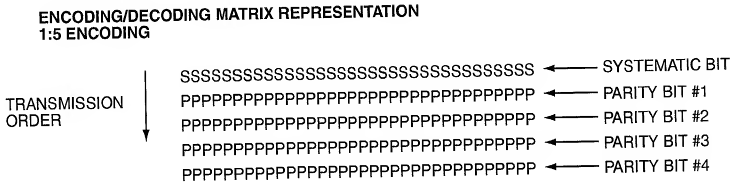
ENCODING/DECODING MATRIX REPRESENTATION
1:5 ENCODING
TRANSMISSION ORDER
SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS
PPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPP
PPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPP
PPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPP
PPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPP
SYSTEMATIC BIT
PARITY BIT #1
PARITY BIT #2
PARITY BIT #3
PARITY BIT #4

FIG. 3

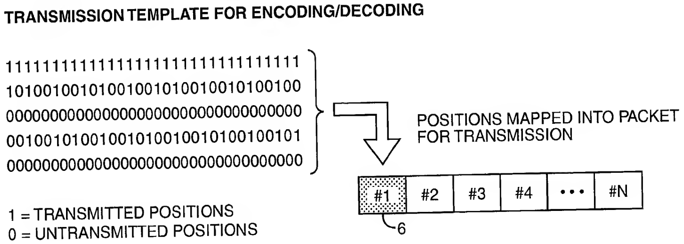
TRANSMISSION TEMPLATE FOR ENCODING/DECODING
11111111111111111111111111111111
10100100101001001010010010100100
00000000000000000000000000000000
00100101001001010010010100100101
00000000000000000000000000000000
1 = TRANSMITTED POSITIONS
0 = UNTRANSMITTED POSITIONS
POSITIONS MAPPED INTO PACKET FOR TRANSMISSION
#1
#2
#3
#4
• • •
#N
6

FIG. 4

PACKET/SUBPACKET TRANSMISSION

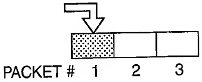

FIG. 5A

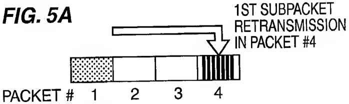
1ST SUBPACKET RETRANSMISSION IN PACKET #4
PACKET #
1
2
3
4

FIG. 5C

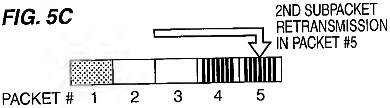
2ND SUBPACKET RETRANSMISSION IN PACKET #5
PACKET #
1
2
3
4
5

FIG. 5E

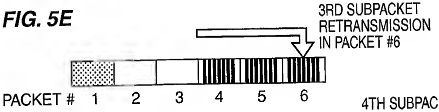
3RD SUBPACKET RETRANSMISSION IN PACKET #6
PACKET #
1
2
3
4
5
6

FIG. 5G

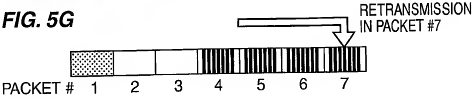
4TH SUBPACKET RETRANSMISSION IN PACKET #7
PACKET #
1
2
3
4
5
6
7

FIG. 5I

PACKET/SUBPACKET RECEPTION

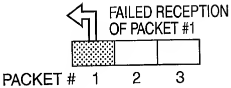
FAILED RECEPTION OF PACKET #1
PACKET #
1
2
3

FIG. 5B

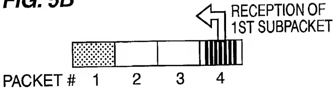
RECEPTION OF 1ST SUBPACKET
PACKET #
1
2
3
4

FIG. 5D

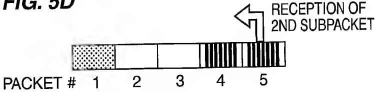
RECEPTION OF 2ND SUBPACKET
PACKET #
1
2
3
4
5

FIG. 5F

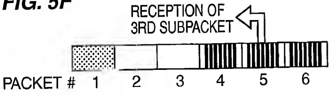
RECEPTION OF 3RD SUBPACKET
PACKET #
1
2
3
4
5
6

FIG. 5H

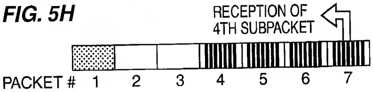
RECEPTION OF 4TH SUBPACKET
PACKET #
1
2
3
4
5
6
7

FIG. 5J

10074701.021302

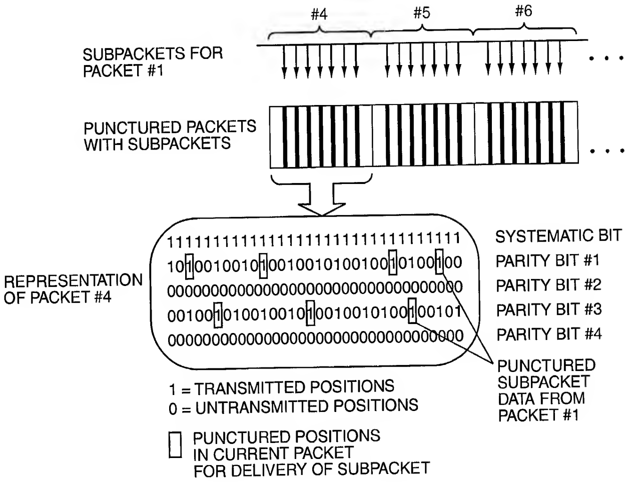
#4
#5
#6
SUBPACKETS FOR PACKET #1
PUNCTURED PACKETS WITH SUBPACKETS
REPRESENTATION OF PACKET #4
11111111111111111111111111111111
10100100101001001010010010100100
00000000000000000000000000000000
00100101001001001010010010100101
00000000000000000000000000000000
SYSTEMATIC BIT
PARITY BIT #1
PARITY BIT #2
PARITY BIT #3
PARITY BIT #4
PUNCTURED SUBPACKET DATA FROM PACKET #1
1 = TRANSMITTED POSITIONS
0 = UNTRANSMITTED POSITIONS
PUNCTURED POSITIONS IN CURRENT PACKET FOR DELIVERY OF SUBPACKET

FIG. 6

10074701.021302

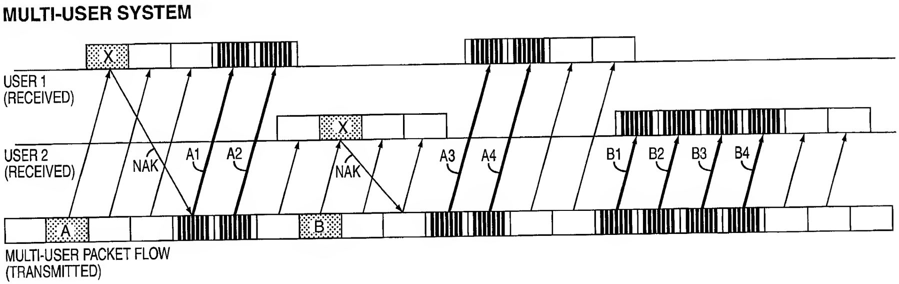
MULTI-USER SYSTEM
X
USER 1
(RECEIVED)
X
USER 2
(RECEIVED)
NAK
A1
A2
NAK
A3
A4
B1
B2
B3
B4
A
B
MULTI-USER PACKET FLOW
(TRANSMITTED)

FIG. 7

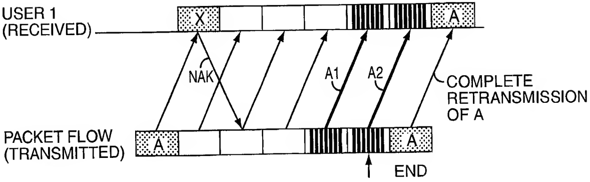
USER 1
(RECEIVED)
X
A
NAK
A1
A2
COMPLETE
RETRANSMISSION
OF A
PACKET FLOW
(TRANSMITTED)
A
A
END

FIG. 8

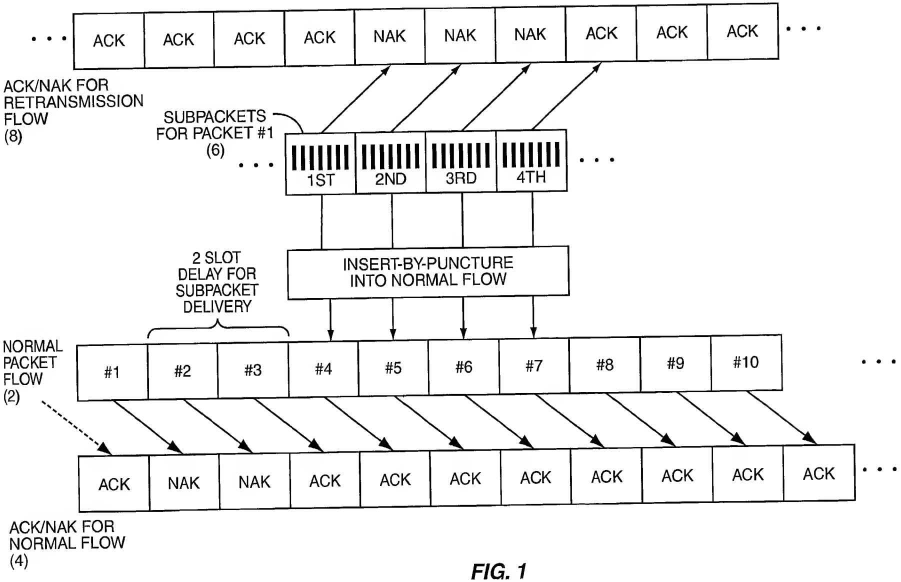
ACK/NAK FOR RETRANSMISSION FLOW (8)
ACK
ACK
ACK
ACK
NAK
NAK
NAK
ACK
ACK
ACK
SUBPACKETS FOR PACKET #1 (6)
1ST
2ND
3RD
4TH
INSERT-BY-PUNCTURE INTO NORMAL FLOW
2 SLOT DELAY FOR SUBPACKET DELIVERY
NORMAL PACKET FLOW (2)
#1
#2
#3
#4
#5
#6
#7
#8
#9
#10
ACK
NAK
NAK
ACK
ACK
ACK
ACK
ACK
ACK
ACK
ACK
ACK/NAK FOR NORMAL FLOW (4)

FIG. 1

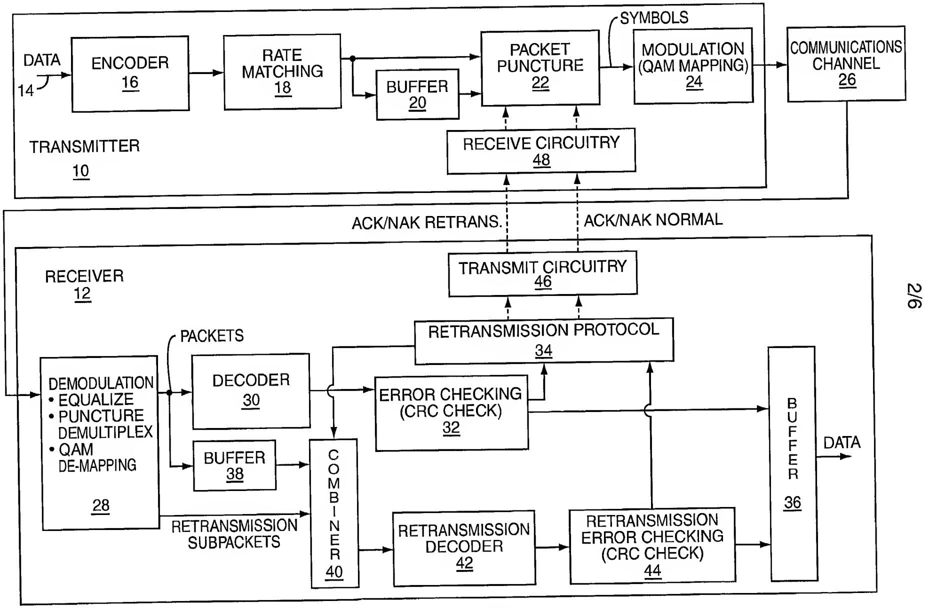
DATA
14
ENCODER 16
RATE MATCHING 18
BUFFER 20
PACKET PUNCTURE 22
SYMBOLS
MODULATION (QAM MAPPING) 24
COMMUNICATIONS CHANNEL 26
RECEIVE CIRCUITRY 48
TRANSMITTER 10
ACK/NAK RETRANS.
ACK/NAK NORMAL
TRANSMIT CIRCUITRY 46
RECEIVER 12
RETRANSMISSION PROTOCOL 34
PACKETS
DEMODULATION
• EQUALIZE
• PUNCTURE DEMULTIPLEX
• QAM DE-MAPPING
28
DECODER 30
BUFFER 38
ERROR CHECKING (CRC CHECK) 32
COMBINER 40
RETRANSMISSION SUBPACKETS
RETRANSMISSION DECODER 42
RETRANSMISSION ERROR CHECKING (CRC CHECK) 44
BUFFER 36
DATA

FIG. 2

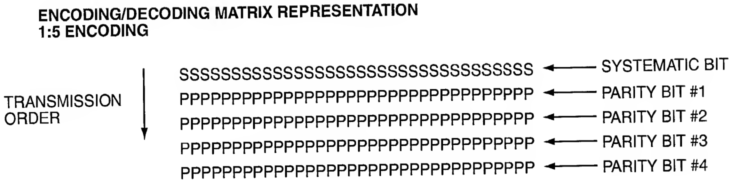
ENCODING/DECODING MATRIX REPRESENTATION
1:5 ENCODING
TRANSMISSION ORDER
SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS
PPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPP
PPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPP
PPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPP
PPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPP
SYSTEMATIC BIT
PARITY BIT #1
PARITY BIT #2
PARITY BIT #3
PARITY BIT #4

FIG. 3

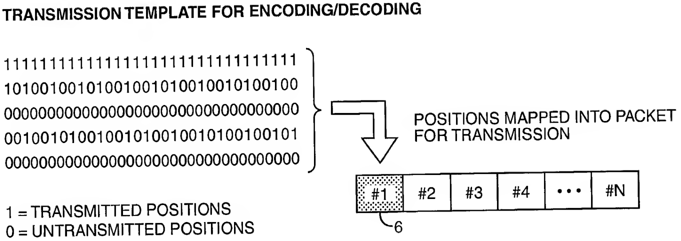
TRANSMISSION TEMPLATE FOR ENCODING/DECODING
11111111111111111111111111111111
10100100101001001010010010100100
00000000000000000000000000000000
00100101001001010010010100100101
00000000000000000000000000000000
1 = TRANSMITTED POSITIONS
0 = UNTRANSMITTED POSITIONS
POSITIONS MAPPED INTO PACKET FOR TRANSMISSION
#1
#2
#3
#4
• • •
#N
6

FIG. 4

PACKET/SUBPACKET TRANSMISSION

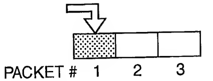

FIG. 5A

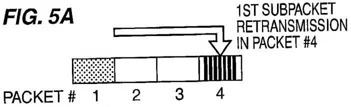
1ST SUBPACKET RETRANSMISSION IN PACKET #4
PACKET #
1
2
3
4

FIG. 5C

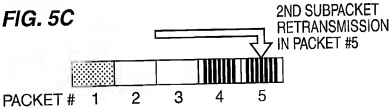
2ND SUBPACKET RETRANSMISSION IN PACKET #5
PACKET #
1
2
3
4
5

FIG. 5E

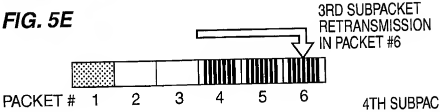
3RD SUBPACKET RETRANSMISSION IN PACKET #6
PACKET #
1
2
3
4
5
6

FIG. 5G

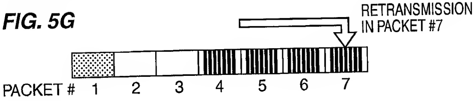
4TH SUBPACKET RETRANSMISSION IN PACKET #7
PACKET #
1
2
3
4
5
6
7

FIG. 5I

PACKET/SUBPACKET RECEPTION

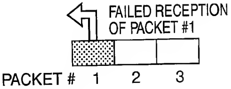
FAILED RECEPTION OF PACKET #1
PACKET #
1
2
3

FIG. 5B

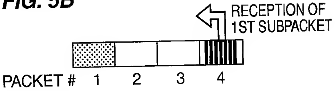
RECEPTION OF 1ST SUBPACKET
PACKET #
1
2
3
4

FIG. 5D

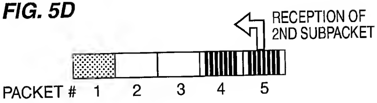
RECEPTION OF 2ND SUBPACKET
PACKET #
1
2
3
4
5

FIG. 5F

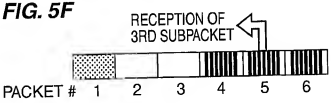
RECEPTION OF 3RD SUBPACKET
PACKET #
1
2
3
4
5
6

FIG. 5H

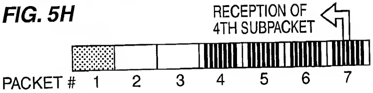
RECEPTION OF 4TH SUBPACKET
PACKET #
1
2
3
4
5
6
7

FIG. 5J

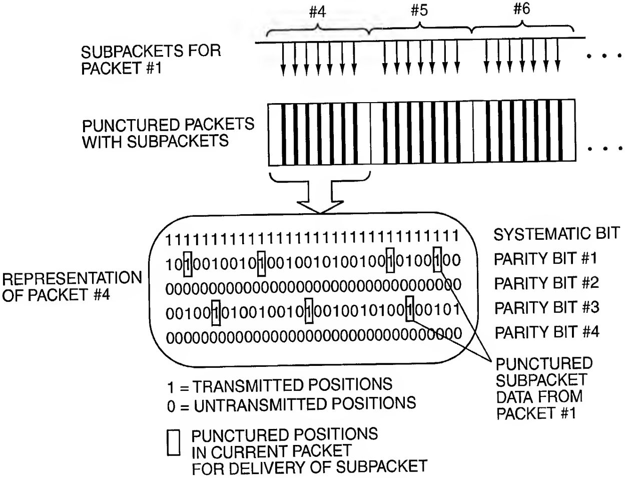
#4
#5
#6
SUBPACKETS FOR PACKET #1
PUNCTURED PACKETS WITH SUBPACKETS
REPRESENTATION OF PACKET #4
11111111111111111111111111111111
10100100101001001010010010100100
00000000000000000000000000000000
00100101001001010010010100100101
00000000000000000000000000000000
SYSTEMATIC BIT
PARITY BIT #1
PARITY BIT #2
PARITY BIT #3
PARITY BIT #4
PUNCTURED SUBPACKET DATA FROM PACKET #1
1 = TRANSMITTED POSITIONS
0 = UNTRANSMITTED POSITIONS
▯ PUNCTURED POSITIONS IN CURRENT PACKET FOR DELIVERY OF SUBPACKET

FIG. 6

10024201.021302

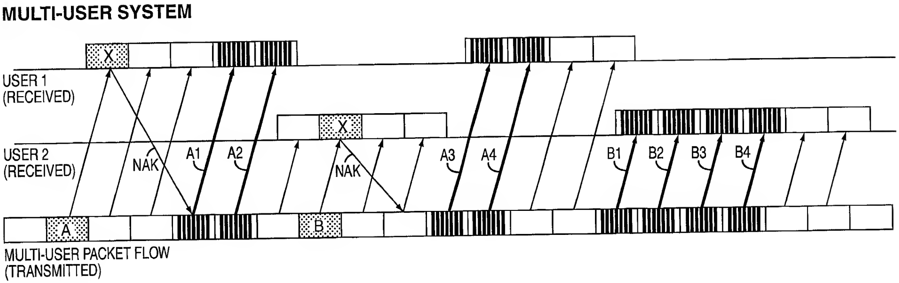
MULTI-USER SYSTEM
X
USER 1
(RECEIVED)
X
USER 2
(RECEIVED)
NAK
A1
A2
NAK
A3
A4
B1
B2
B3
B4
A
B
MULTI-USER PACKET FLOW
(TRANSMITTED)

FIG. 7

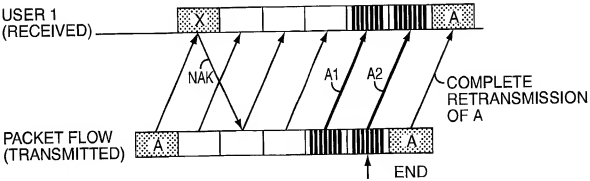
USER 1
(RECEIVED)
X
A
NAK
A1
A2
COMPLETE
RETRANSMISSION
OF A
PACKET FLOW
(TRANSMITTED)
A
A
END

FIG. 8

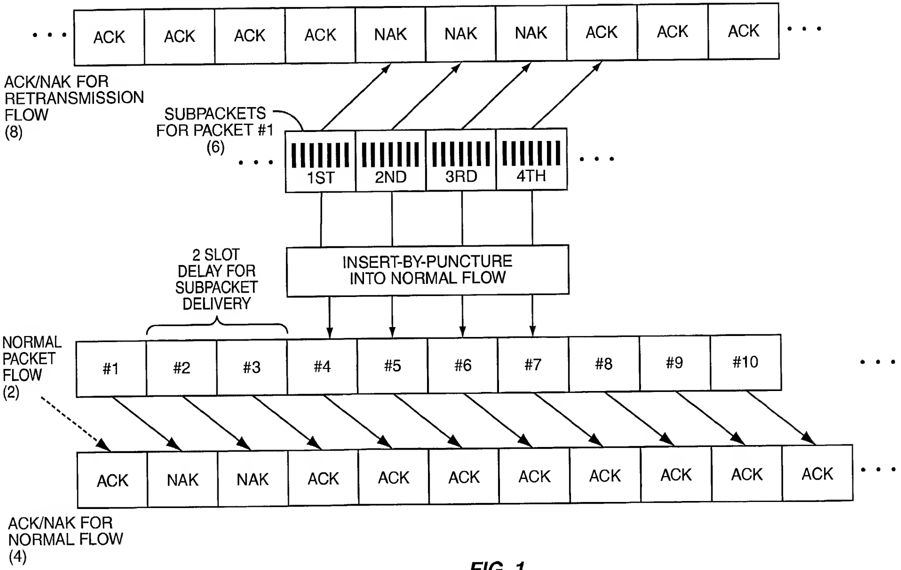
ACK
ACK
ACK
ACK
NAK
NAK
NAK
ACK
ACK
ACK
ACK/NAK FOR RETRANSMISSION FLOW (8)
SUBPACKETS FOR PACKET #1 (6)
1ST
2ND
3RD
4TH
INSERT-BY-PUNCTURE INTO NORMAL FLOW
2 SLOT DELAY FOR SUBPACKET DELIVERY
NORMAL PACKET FLOW (2)
#1
#2
#3
#4
#5
#6
#7
#8
#9
#10
ACK
NAK
NAK
ACK
ACK
ACK
ACK
ACK
ACK
ACK
ACK
ACK/NAK FOR NORMAL FLOW (4)

FIG. 1

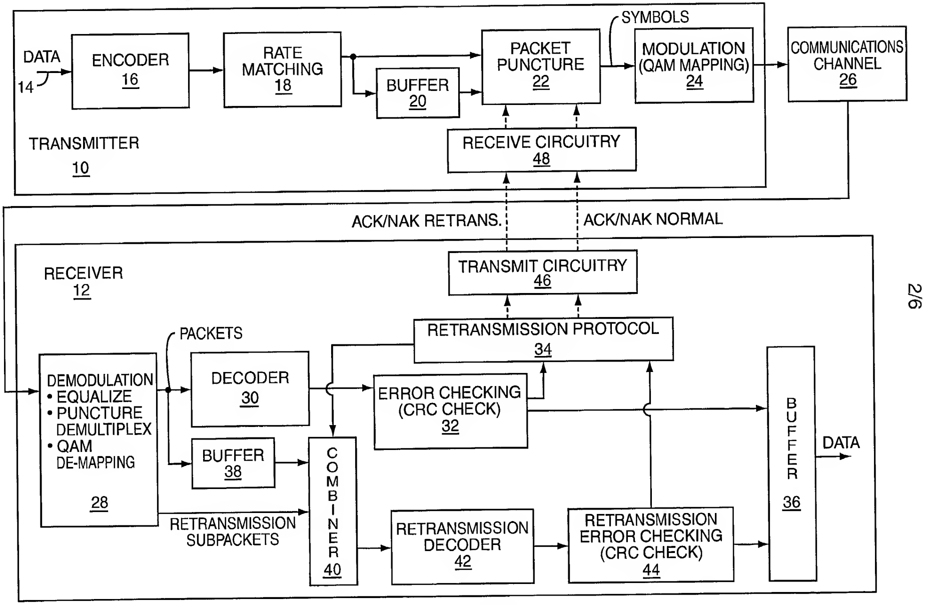
DATA
14
ENCODER
16
RATE MATCHING
18
BUFFER
20
PACKET PUNCTURE
22
SYMBOLS
MODULATION (QAM MAPPING)
24
COMMUNICATIONS CHANNEL
26
TRANSMITTER
10
RECEIVE CIRCUITRY
48
ACK/NAK RETRANS.
ACK/NAK NORMAL
RECEIVER
12
TRANSMIT CIRCUITRY
46
PACKETS
RETRANSMISSION PROTOCOL
34
DEMODULATION
• EQUALIZE
• PUNCTURE
DEMULTIPLEX
• QAM
DE-MAPPING
28
DECODER
30
ERROR CHECKING (CRC CHECK)
32
BUFFER
38
COMBINER
40
BUFFER
36
DATA
RETRANSMISSION SUBPACKETS
RETRANSMISSION DECODER
42
RETRANSMISSION ERROR CHECKING (CRC CHECK)
44

FIG. 2

ENCODING/DECODING MATRIX REPRESENTATION
1:5 ENCODING

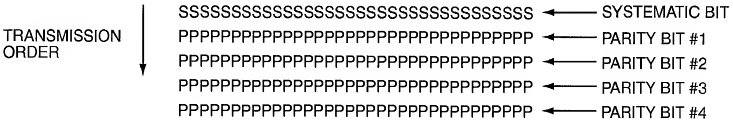
TRANSMISSION ORDER
SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS
PPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPP
PPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPP
PPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPP
PPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPP
SYSTEMATIC BIT
PARITY BIT #1
PARITY BIT #2
PARITY BIT #3
PARITY BIT #4

FIG. 3

TRANSMISSION TEMPLATE FOR ENCODING/DECODING

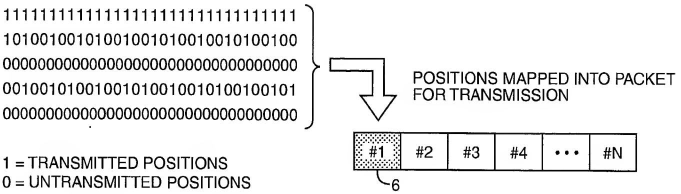
11111111111111111111111111111111
10100100101001001010010010100100
00000000000000000000000000000000
00100101001001010010010100100101
00000000000000000000000000000000
1 = TRANSMITTED POSITIONS
0 = UNTRANSMITTED POSITIONS
POSITIONS MAPPED INTO PACKET FOR TRANSMISSION
#1
#2
#3
#4
• • •
#N
6

FIG. 4

PACKET/SUBPACKET TRANSMISSION

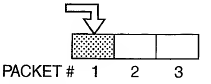

FIG. 5A

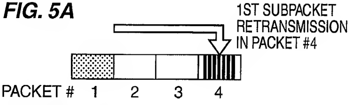
1ST SUBPACKET RETRANSMISSION IN PACKET #4
PACKET #
1
2
3
4

FIG. 5C

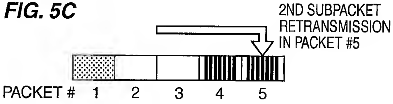
2ND SUBPACKET RETRANSMISSION IN PACKET #5
PACKET #
1
2
3
4
5

FIG. 5E

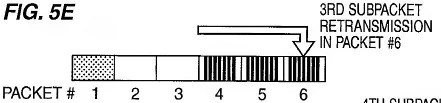
3RD SUBPACKET RETRANSMISSION IN PACKET #6
PACKET #
1
2
3
4
5
6

FIG. 5G

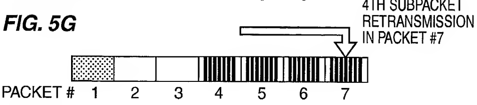
4TH SUBPACKET RETRANSMISSION IN PACKET #7
PACKET #
1
2
3
4
5
6
7

FIG. 5I

PACKET/SUBPACKET RECEPTION

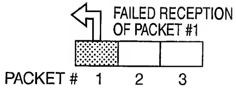
FAILED RECEPTION OF PACKET #1
PACKET #
1
2
3

FIG. 5B

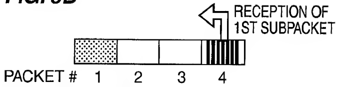
RECEPTION OF 1ST SUBPACKET
PACKET #
1
2
3
4

FIG. 5D

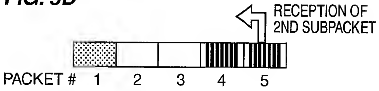
RECEPTION OF 2ND SUBPACKET
PACKET #
1
2
3
4
5

FIG. 5F

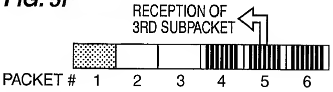
RECEPTION OF 3RD SUBPACKET
PACKET #
1
2
3
4
5
6

FIG. 5H

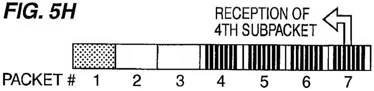
RECEPTION OF 4TH SUBPACKET
PACKET #
1
2
3
4
5
6
7

FIG. 5J

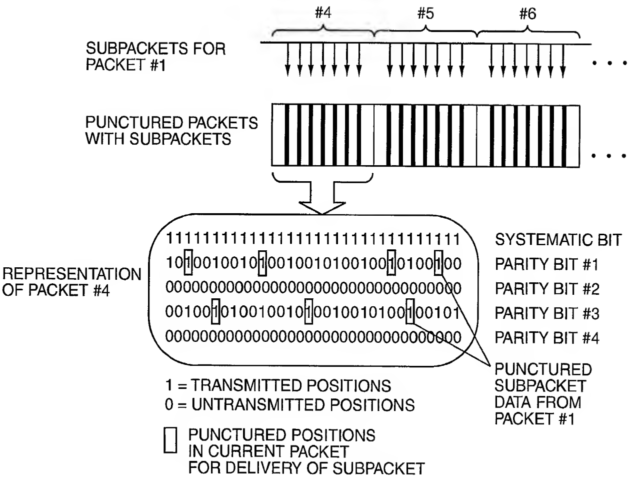
#4
#5
#6
SUBPACKETS FOR PACKET #1
PUNCTURED PACKETS WITH SUBPACKETS
REPRESENTATION OF PACKET #4
11111111111111111111111111111111
10100100101001001010010010100100
00000000000000000000000000000000
00100101001001010010010100100101
00000000000000000000000000000000
SYSTEMATIC BIT
PARITY BIT #1
PARITY BIT #2
PARITY BIT #3
PARITY BIT #4
PUNCTURED SUBPACKET DATA FROM PACKET #1
1 = TRANSMITTED POSITIONS
0 = UNTRANSMITTED POSITIONS
PUNCTURED POSITIONS IN CURRENT PACKET FOR DELIVERY OF SUBPACKET

FIG. 6

MULTI-USER SYSTEM

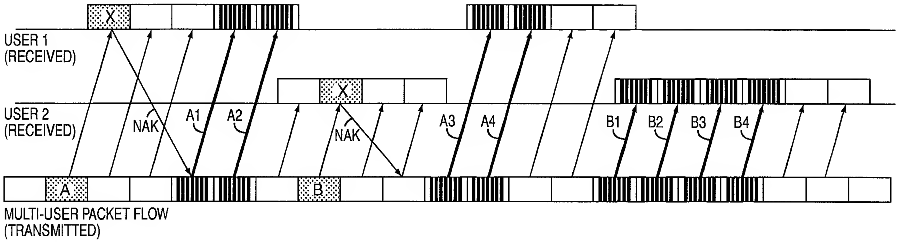
USER 1
(RECEIVED)
USER 2
(RECEIVED)
MULTI-USER PACKET FLOW
(TRANSMITTED)
X
A
B
NAK
A1
A2
A3
A4
B1
B2
B3
B4

FIG. 7

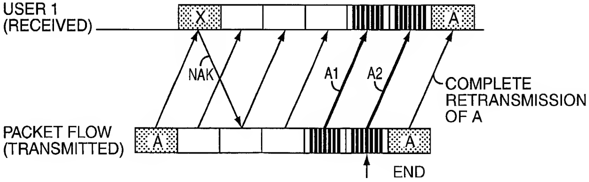
USER 1
(RECEIVED)
PACKET FLOW
(TRANSMITTED)
X
A
NAK
A1
A2
COMPLETE
RETRANSMISSION
OF A
END

FIG. 8